

is wholly unfit for the purpose, on account of its saline matters.

The proportion of clean sand should always exceed that of the lime, thus an excellent common mortar can be made of three parts of fine sand, four parts of coarse sand, and one part of the best slaked lime beaten up with as small a quantity of water as practicable.

Such mortar may be used immediately, or if placed from the air in pits, it may be preserved for a great length of time without suffering any deterioration; on the contrary, probably the older it is the better, because the lime becomes most perfectly hydrated, and intimately mixed with the sand, every grain of which becomes fully encrusted.

Then, a short time previous to the employment of such mortar, it must be mixed with a little water and perfectly well "gaged." It will soon "dry or set," because the lime and sand are in a favourable state for acting upon each other as also upon the air. *Silicate of lime* and *carbonate of lime* are simultaneously produced, and the mortar assumes the firmness of stone.

The superiority of Roman mortar over that now commonly used was referable, in the first case, to the care taken in the selection of proper materials, and in the next, to the age and maturity of the mortar before it was employed in construction. There are many persons who, in their enthusiasm for every thing bearing the stamp of antiquity, will state that "nothing like ancient mortar can be now produced, even with all the means and appliances of science, in fact that the secret is lost, and that science cannot direct the way in which it is to be discovered."

But this is not the case; real practical men can produce mortar that in the course of a few years will rival in hardness any Roman specimen, providing they choose a good limestone, have it thoroughly calcined, its lime perfectly slaked, mixing this with a clean, sharp grained, silicious sand, and pure water, and permitting the mortar to become matured by burying it out of the contact of air.

There is no secret to be mourned after or hunted out, for Pliny and Vitruvius expressly mention that the firmness of the mortar of the buildings of Rome was due to its careful preparation, and its three years' maturity before employment.

The Greeks were very scrupulous in their attention concerning the mixing and blending of mortar; ten men were constantly employed to each "basin" of materials, stirring, mixing, and incorporating them together; and Vitruvius states, that such mortar, or plaster, when set after the lapse of years, was so excessively hard as to serve for the formation of tables.

It was a maxim with old masons to their workmen, that "they should dilute with the sweat of their brow," that is, "labour the mortar for a long time, instead of drowning it with water, in order to have done the sooner."

These ancient worthies would be petrified with horror could they behold the process so commonly followed at present for making the trash called mortar, that is destined for "running up" the cheap and bad buildings which disgrace the environs of the metropolis.

In the first place, the lime is often imperfectly burned; in the next, it is brought in wagons or carts regardless of the weather, "fair, changeable, or ruin," and "shot" near the site of the proposed erection, where it probably remains for some days, whilst a shew of protection from the weather is made by covering it with ragged sacks, tattered tarpaulin, or shattered wainscotting.

During the interval, several carts arrive heavily laden with the sweepings and scrapings of the roads ("road stuff") abounding in vegetable and animal offal, and filth of every description. A board conspicuously placed announces "Rubbish may be shot here;" a passer-by would naturally imagine that the "road stuff" came under the denomination of "rubbish," and that the scavengers were eagerly availing themselves of the permission for its deposition;—no such thing,—this foul "road stuff" is destined to enact the part of the "clean river sand" that was formerly used, and should still be used in the formation of mortar.

Two or three loads of "road stuff" are stratified with a load of the lime, then water, not always of the cleanest description is thrown on

the heap, and the slaking proceeds most imperfectly; this mixture is subsequently "screened" to separate the unburnt lime-stones or other stones, then drenched with water and made into a paste with the least possible expenditure of human labour and attention.

Such is the "mortar" as it is carried to the bricklayers, who apply it to cheap, porous, bricks; these are sometimes warm, nay even hot from the kiln; the water is therefore rapidly absorbed as by sponges, scarcely any silicate of lime can form, and very little carbonate of lime, since the lime was probably bad in the first place, rendered worse by exposure, and encumbered, like the silica or sand of the "road stuff," with extraneous matters.

These things are unheeded, the work proceeds, the walls rise above ground like mushrooms; the carpenters, and then the joiners, make their appearance, and in fixing scanty beams, slender rafters, thin flooring boards, attenuated sash-frames, flimsy staircases, contorted handrails, "shaky" skirtings, and "sappy" panelled doors, they keep the "carcass" in a violent tremor, instead of permitting the calm repose which is so essential to its frail constitution.

Suppose the "carcass" sustain these shocks, and the weight of the slating, tiling, iron, and other metal work; the plasterers are introduced to commence their decorative operations; they cover the bare and trembling walls first of all with a coating of the aforesaid "mortar," and afterwards with a coating of "fine stuff," then leave work, highly gratified at the smooth change which their labour has wrought upon the rugged state of affairs. All looks well, but soon the respective apartments become saturated with the vapour of water, produced by the drying of the plastering, and then the woodwork begins to swell, "cast," and crack into various deviations from its intended rectitude of shape, in consequence of absorbing water. This is unheeded; the painters begin, and disguise such deformities by the joint agency of "stopping, knotting, putty, and priming." In the course of a few days the plastered walls that should be smooth and fair, are covered with excrescences and unsightly eruptions. Surely this defacement is not an act of wanton mischief!—No!—Then what is its cause? Why the lime of the "fine stuff" was as badly slaked as that of the mortar, and, therefore, numberless portions of it remained "quick," caustic, or anhydrous, up to the time of its application by the plasterer's trowel; and then, slowly absorbing water from the coarse coating beneath, or from its own coating, such portions slake and swell, and rise in lumps or blisters. These are all patched up and repaired as quickly as possible, because the paper-hangers must come in; but perchance the walls are yet too "green" for their admission, or the weather is damp, the walls must be dried.

Accordingly, a large brazier, filled with burning charcoal, is introduced, and set on the floor in the centre of the room, exactly under a flimsy showy "patera," in the centre of the newly-plastered ceiling; the charcoal burns, the room becomes very hot,—the heated products of combustion chiefly accumulating in the vicinity of the patera and mouldings. These, probably, cannot stand such treatment, for the rapid drying causes them to crack, perchance to fall, whilst cracks and fissures, infinite in the variety of their magnitude and shape, appear upon the ceiling and the walls, all announcing the result of the forcible abstraction of water by the hurried heat of drying.

"Repairs executed on the shortest notice, and the most reasonable terms," the ceiling is restored to a decent appearance, the cracks in the walls are filled without regard to any appearance, and at last all this clobbering is hidden from the sight by "a gaudy penny paper," the colours of which are soon acted upon by the lime of the plaster, and are ever varying as the hues of the chameleon.

But what has become of the painters' work and the iron stores all this time? Why, exposed as they have been to an atmosphere saturated with water, every patch and spot of the "knotting" can be seen through the thin and finishing coat of paint; whilst the stores have rusted, and the rust has stained the stone or marble mantel-piece.

Then upon "lighting a fire," the chaoes

are that the chimney will not draw, but clouds of smoke, instead of ascending through their destined channel, rebel, and roll down and fill the room. In general, rain is the hope "that things will be better when the chimney is dry," the smoke nuisance continues, discolouring ceiling, paper, and paint.

"A chimney doctor" is consulted. He suggests that "coring is wanted, or may be a brick is sticking out somewhere," but engages to make the "chimney draw" by putting a metal funnel on the chimney-pot, forgetting that the chimney is a long crooked passage, chilling the smoke, and thus depriving it of ascensional force, so that the attempt to cure the evil by such means, is like having a short, straight lane at the end of a long winding road, to give strength to a jaded horse, and make him "draw."

Such are a few, and a few only, of the unscientific proceedings that are adopted in the construction of cheap modern dwellings; and if space would allow, many other examples of the same kind might be brought forward (as probably they will be, at a future opportunity), but mention must now be made of some mixtures in which lime enacts a part as important as it does in ordinary good mortar.

"Grout," or liquid mortar, has the advantage of penetrating the pores of the bricks by capillary attraction, perfectly filling them, and ultimately setting into a hard mass of silicate and carbonate of lime, thus conferring great firmness and strength.

The researches of the chemist teach that the varieties of limestone, containing a portion of *alumina* (clay) and oxide of iron, yield, when calcined, a lime having considerable superiority over pure lime. The lime now alluded to is technically called *meagre lime*, of which the "Dorking lime" presents a specimen. The lime obtained from a pure simple limestone is white, or nearly so, whilst that from an aluminous-ferruginous limestone has a buff, brown, or ochrey tinge; this announces the presence of oxide of iron, and such lime is the best for "cements."

Common mortar soon softens and disintegrates, if exposed to the action of water before it has had time to harden; and, therefore, in order to form "water," or "hydraulic mortar," a different mixture of materials is required.

Certain portions of *alumina* and oxide of iron are added to the lime and sand; this mixture being well tempered with water, will "set or harden" under water, but a native ferruginous clay may be used (as it contains *alumina*, silica, and oxide of iron), although not in its crude or raw state, to mix with lime, because it will effectually prevent the induration of the mortar: let it be calcined and rendered anhydrous, then mix it with lime and water, and it will harden under water.

Some natural productions contain the above requisite ingredients already calcined, and fit for immediate use; *puzzolano* for example as ejected from Vesuvius, when finely powdered, sifted, and properly mixed with lime, forms the ancient "Roman cement."

"Trass or terras," a variety of basalt supposed to be of volcanic origin, acts similarly to *puzzolano*, and is used in making the water cement that is so much employed in Holland, and where the foregoing materials cannot be had, the nodular masses called *septaria* may be advantageously calcined, to yield the hydraulic mortar known as "Parker's cement."

All hydraulic mortars and cements should be slowly dried, and from many experiments that have been made upon this truly important subject, it appears that their strength increases as they are suffered to dry out of the contact of air. The theory of the hardening of these cements consists in the strong chemical affinity that exists between silica, *alumina*, lime, and oxide of iron, and thus not only is a single silicate of lime formed as in ordinary mortar, but also silicates of *alumina* and of oxide of iron; these have the power of combining, and of remaining combined against the solvent power of water.

THE NAPOLEON MONUMENT.—The Emperor of Russia has ordered blocks of the splendid porphyry of the Crowa Quarries to be sent to Paris, in order to meet the wishes of the French Government to obtain the finest porphyry in the world, wherever their agents could procure it, for the monument at the Invalides.